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AUTHOR Biddulph, Fred
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ABSTRACT

The first (exploratory) phase of the Learning in Science Project (Primary)--LISP(P)--focused on science teaching/learning in New Zealand primary schools. Project goals included the identification of major problems of classroom teaching and learning and the study of factors which promote or limit individual children's learning of science. This paper reports on some of these problems and issues. Information was obtained in unstructured audio-taped interviews from: primary inspectors, teachers' college staff, advisers, and non-teaching primary school principals (N=23); classroom teachers (N=24); and mixed ability children (N=35). Analyses of transcripts are reported in two parts. The first part (focusing on primary children learning science) addresses problems and issues related to the amount of science encountered, the purpose of activities, answering strategies, attitudes based on school experiences, ideas gained, and how children learn outside of school. The second part (focusing on primary teachers teaching science) addresses issues and problems related to teacher background in science, science equipment, science education goals, amount of science taken, teaching methods, science syllabi and resource units, and teacher background in curriculum development. One conclusion is that little time is devoted to teaching science and that instruction is often a matter of "covering topics" rather than helping children learn. (JN)

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LEARNING IN SCIENCE PROJECT (PRIMARY)

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PRIMARY SCIENCE: THE VIEWS OF TEACHERS AND PUPILS

Science Education Research Unit
University of Waikato
Hamilton, N.Z.

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Working Paper No. 102

PRIMARY SCIENCE: THE VIEWS OF TEACHERS AND PUPILS

Fred Biddulph

July 1982

A Working Paper of the Learning in Science Project (Primary)

INTRODUCTION

As a result of the Learning in Science Project (Form 1-4) conducted by the University of Waikato during 1979-81, the New Zealand Department of Education provided the University with further funding for 1982-84 for a Learning in Science Project (Primary). In looking at science in New Zealand primary schools this project was required, among other things, to identify the major problems of class teaching and learning, and to study factors which promote or limit individual children's learning of science. This paper reports on some of these problems and issues.

Information was obtained in unstructured audio-taped interviews with three different groups of people. The first group might be classified 'outside observers'. During April/May 1982, a total of twenty-three people in this group were asked about and related their views on the state of science teaching and learning in New Zealand primary schools. The group consisted of primary inspectors, teachers' college staff, advisers and non-teaching primary school principals from four parts of New Zealand (see Table 1).

It is emphasised that no claim is made that the interviewing involved a representative sample; its purpose was simply to explore a range of experiences of science teaching and learning.

TABLE 1: Number of 'Outside Observers' interviewed

PEOPLE	HAMILTON/ROTORUA/PALMERSTON NORTH	CHRISTCHURCH	TOTAL
Inspectors	2	4	6
Teachers' College science staff	6	1	7
Science advisers	3	3	6
Rural adviser	0	1	1
Principals	1	2	3
	12	11	23

The second group of people consisted of practising teachers. Twenty-four practising teachers from eight different schools in Hamilton, Christchurch and rural areas close to these two cities (see Table 2) were interviewed in April/May 1982.

TABLE 2: Number of teachers interviewed

CLASS LEVEL	HAMILTON WOMEN	HAMILTON MEN	CHRISTCHURCH WOMEN	CHRISTCHURCH MEN	TOTAL
Junior	6	0	1	0	7
S.1/2	2	4	0	0	6
S.3/4	3	5	0	3	11
	11	9	1	3	24

The third group of people consisted of children. Thirty-five mixed-ability children from four Christchurch urban schools were interviewed in April/May 1982 (see Table 3). In the interviews the children were asked in a semi-structured way about their experiences of learning science at school.

TABLE 3: Number of children interviewed

CLASS LEVEL	GIRLS	BOYS	TOTAL
S.2	4	4	8
S.3	4	5	9
S.4	4	4	8
F.1	5	5	10
	17	18	35

The Form 1 children were at an intermediate school and were selected so that there was at least one boy and one girl from each of the four schools that contributed to the intermediate school. These children were asked about their science experiences in S.3/4. The thirty-five children

were therefore speaking of their science experiences with approximately twenty teachers in six schools during the last two years or so.

An analysis of the transcripts revealed that teachers perceived a number of problems teaching science and that the children perceived certain problems in learning about science. These problems, together with several related issues disclosed in the transcript analysis, are now described and in many instances illustrated with quotations from the transcripts. Many of the problems reported are similar to the ones identified by the Learning in Science Project (Form 1-4) research (Osborne & Freyberg, 1982) and by overseas research in science education. Such similarities are noted as they indicate that science teaching/learning in New Zealand primary schools does not have a unique set of problems.

PRIMARY CHILDREN LEARNING SCIENCE

1. Amount of Science Encountered

All of the children interviewed were asked whether they had been taught science. They all stated that they had been taught at least some science although three out of the thirty-five specifically mentioned that it hadn't been very much.

> Interviewer: What other things did you do last year then, apart from trees?
>
> Girl: Oh we didn't because we only did it for about half the year and then he stopped taking science. (F.1 girl)

2. Purpose of Activities

When pupils mentioned a specific science lesson they were asked by the interviewer what they considered to be the purpose of the activity. Four children were able to suggest a reasonable purpose of the science activity mentioned. However, at least eight of the children were quite unable to suggest even a possible purpose:

Interviewer: What was the whole purpose of that study, to your way of thinking?

Girl: Um, (pause and then half laughs) I don't really know.

Interviewer: Well, why did you study it?

Girl: Because the teacher told us to. (Laughs again)
(Std. 4 girl)

Perhaps this failure by some children to understand the purpose of various science activities is not surprising. An inspector reported that many teachers don't know either.

> "there are few teachers who have clear aims for the lessons they are taking."
> (Primary inspector)

This problem of children not understanding the purpose of science activities was also identified by the research of the F.1-4 Project (Working Paper No. 6, p.7).

Comment from the children and teachers suggested that children sometimes perceive science activity involvement as a kind of game that they play with the teacher. For example,

> "You just do it (write notes) to please the teacher."
> (F.1 boy)

> "... so often as teachers we ask children for the answer and the hands go up and that's it; that's what the teacher wants and they're trying to please the teacher."
> (Std.3/4 teacher)

> "Kids play games with teachers ... if the teacher thinks such and such effects are going to be found then kids are going to find them." (Teachers College Lecturer)

This same problem of students seeing the purpose of science lessons as finding <u>the</u> right answer, that is, the teacher's answer, was revealed by the F.1-4 Project research (Working Paper No. 2, p.4).

3. <u>Answering Strategies</u>

One inspector suggested that if the task is perceived by the children as

getting the right answer then some children use a strategy which involves manipulating the teacher.

> "... the children expect to ... receive the answers ... so why bother doing a lot of thinking; if you stall and hold off the teacher in desperation at the end is going to give you the answer."
>
> (Primary Inspector)

A similar strategy was found among older children by members of the F.1-4 Project (Working Paper No. 9, p.13).

4. Attitudes Based on School Experiences

(a) Interested

Almost half the number of children interviewed said that they were interested in science or at least in some aspects of science. Two main reasons were given for this.

(i) Enjoyment of 'hands-on' activities: Eight of the fourteen children who reported having had first-hand experiences in science, indicated that they enjoyed the practical activities. For example,

> "I found it rather pleasant because there were lots of experiments and all this sort of stuff."
>
> (F.1 boy)

> "I liked finding the wee crabs at Taylors Mistake."
>
> (S.2 girl)

One girl mentioned an aspect of science that appealed to her.

> "There is one thing I do enjoy doing on a topic and that's the title page, writing down the title and drawing things about it and that."
>
> (S.3 girl)

Children's interest in science stemming from an experiential approach was also noted in two reports on the research of the F.1-4 Project (Working Paper No. 2, p.2; Working Paper No. 6, p.3).

(ii) New things are learned: Six of the children commented on how they liked science because they learned new things.

"You find out new things that you don't know and that you've never heard of."

(S.4 boy)

(b) Bored

Half or more of the children displayed negative attitudes toward science, or some parts of it. For example,

"Sometimes it's just boring kind of science."
(S.2 girl)

"When someone said, 'It's science today' everyone went, 'Awwwh!'"
(F.1 boy)

The conversations with the children revealed five main reasons why science was disliked.

(i) Too much teacher talk: four children felt bored when their teacher talked at them for lengthy periods.

"Mrs ... would sit and talk for hours and we'd just slowly go to sleep, not listen."
(S.4 girl)

(ii) Too much writing: seven children disliked what they regarded as the extensive note-taking requirements of science. The following conversation took place after one boy said that he didn't like science very much.

Interviewer: What is it that you don't like very much?

Boy: Writing stuff down and all that.
(S.2 boy)

The F.1-4 Project research reported students at a higher level expressing the same feeling (Working Paper No. 6, p.3).

(iii) Topic repetition: one boy spoke of the effect on him of studying the same topic for several years on end.

"a lot of it we did year after year, and by Std. 4 it got fairly boring."
(F.1 boy)

A girl referred to the feeling that she experienced when the same topic was studied in an extended way in the course of one year.

"We got talking about 'matter' after a while and that got a bit boring because you kept going over and over it again talking about what 'matter' was."
(F.1 girl)

The research of the F.1-4 Project revealed this problem at higher levels as well (Working Paper No. 6, p.4).

(iv) Too abstract, little first-hand experience: four children referred to teachers taking science in a verbal or semi-abstract manner. A F.1 girl described a typical science lesson that she experienced at primary school.

"Well he (teacher) sort of talked about it first. Then he'd write something on the board. Sometimes he'd show us pictures in books and get books to read."
(F.1 girl)

One boy reflected on a problem of learning inherent in this kind of experience.

"... in a book all you can feel is just the page but you can't feel the actual thing."
(F.1 boy)

The abstract nature of this approach was recognised by several teachers. For example:

"Because there is such a lot (in the units) you tend to make it technical and the kids tend to, perhaps they do get bored."
(S.3/4 teacher)

The abstract nature of some science lessons was also mentioned by the F.1-4 Project (Working Paper No. 6, p.4).

(v) Not understood: eleven children said that they didn't understand the work at times. Sometimes it was the ideas that were not understood.

"Sometimes she doesn't really explain it properly."
(S.3 boy)

"... some things are too hard to understand."
(S.2 girl)

"I try to listen in to everything but sometimes they (teachers) talk about things you can't understand really."
(S.3 boy)

On other occasions it was the vocabulary that was not understood.

"Sometimes she puts hard words on the board and you don't know what that word means."
(S.3 boy)

Confirmation of this problem comes from a primary inspector who observed that teachers

"... use a lot of vocab and jargon that they (children) wouldn't understand."
(Primary Inspector)

The F.1-4 Project members found the same problem at the intermediate and secondary level (Working Paper No. 6, p.4).

A third occasion when the children had difficulty understanding was when the teacher got a bit ahead of them. One pupil stated,

"Sometimes it's a bit hard to understand the way that the circuit's going on the board because there's too much things stuck there. You're trying to understand one thing and he's gone too fast and he's writing up another thing."
(S.4 girl)

5. Ideas Gained

One teacher recognised that the children do not necessarily form the ideas that the teacher has in mind.

"You think they've got the right ideas about things but you'd be surprised sometimes what they really have."
(NE/J.3 teacher)

The same teacher was aware that children tend to construct their own meanings from their experiences and previous thoughts.

"I think children tend to get an idea and form an opinion themselves, I suppose."
(NE/J.3 teacher)

This is consistent with one of the major findings of the F.1-4 Project team as set out in their final report (Tasker et al, 1982).

6. Finding Out

During the interviews with the primary school children the opportunity was taken to question them about the strategies they use for finding out things when they are not at school. All of the children indicated that they ask parents or relatives, some said that they look in books or other reference material, and a few described how they look at, or think about the thing more closely or more carefully.

PRIMARY TEACHERS TEACHING SCIENCE

1. Teacher Background in Science

(a) Lack of scientific knowledge and lack of experience in scientific inquiry

Lack of knowledge of science concepts and propositions by teachers was mentioned many times by both 'outside observers' and teachers themselves. For example

> "Lack of knowledge and lack of interest on the teachers' part. That would be the major problem I think."
> (STJC)

> "I think that would be one of the difficulties a lot of teachers are confronted with, lack of knowledge in each (science) area."
> (Junior class teacher)

Five teachers described the effect that a lack of knowledge had on their teaching of science. For example,

> "... a lack of personal knowledge in some areas tends to restrict what I attempt to do."
> (S.2/4 teacher)

> "... the greatest problem for me is a lack of background knowledge of biology. Because of that I tend to shy away from nature study and I find all sorts of excuses for not doing nature study. I'll do something else instead."
> (S.2/3 teacher)

This lack of science knowledge on the part of the teachers was also reported by the F.1-4 Project team (Working Paper No.5, p.7; Working Paper No. 9, p.13) and seems to be the case in Britain as well (HMI Report, 1978).

Some teachers have problems with the language of science as used in the infants - Std.4 syllabus, even with the name 'science' itself, but they may not be willing to disclose that they don't understand what the words mean.

> "... particularly the younger teachers won't admit sometimes that they don't know some of the terminology."
> (STJC)

Quite likely they have constructed their own private meanings for the terms as an inspector explained.

> "They've (teachers) brought their own meanings to them in lots of ways."
> (Primary Inspector)

Just what these meanings are remains unexplored at present.

(b) Lack of Confidence

A lack of understanding of science leads to a lack of confidence in teaching science. Teachers' lack of confidence was mentioned frequently with thirteen teachers and eleven 'outside observers' referring to it in one way or another. For example,

> "I think most of them, most teachers lack confidence ... I think it's a point I certainly hear stated by a great number of the younger female teachers."
> (Rural Schools Adviser)

> "... if a little bit more could be provided in the way of teacher background I think that I would probably feel more confident taking some things."
> (Std.2/4 teacher)

British primary teachers share this lack of confidence in teaching science (HMI Report, 1978).

(c) Training is inadequate or inappropriate

(i) Preservice: Teacher's college staff and some others interviewed remarked on the insufficient time allocated to the training of student teachers in science. This point was also made by members of the F.1-4 Project team (Working Paper No. 5, p.11).

(ii) Inservice: Two teachers mentioned that inservice courses have not seemed appropriate to their needs.

> "The last science course I went to ... was absolutely boring and a waste of time (laughs) as far as I was concerned."
> (Junior class teacher)

> "For me those kind of courses (one or two day) have never really given me a long term interest in teaching the subject, or a long term security in the teaching of the subject."
> (S.3 teacher)

The inappropriateness of some inservice science courses was also reported by the F.1-4 Project members (Working Paper No. 5, p.18).

(d) Advisory service doesn't suit some teachers

One experienced teacher remarked on the value of science advisers.

> "... the specialists have never worked for me. I've given up using them to be quite honest."
> (S.3 teacher)

An Education Department science curriculum officer felt that this reflects a difference in the quality of science advice that is available in different parts of the country.

2. Equipment

(a) Inadequacy or unavailability can inhibit the teaching/learning of science

Although the kitsets of equipment supplied to schools by the Department of Education are appreciated, nine teachers and seven 'outside observers' nevertheless expressed considerable concern about equipment not being available either because there was insufficient in the schools, particularly larger schools, or because it was not readily accessible.

One principal summarised the problems surrounding the organisation of equipment and resources when he said,

> "If you make it too casual then the blasted stuff gets lost around the place, and if you over-organise it then teachers have an inborn reluctance to bother about it because it's too difficult."
>
> (Primary principal)

When teachers cannot easily get hold of the equipment that they need they may put science to one side. For example,

> "... it is a frustration and a difficulty, a time-consuming difficulty if you have to chase round for equipment. It tends to mean that you do much less and in some cases nothing."
>
> (S.3/4 teacher)

> "... the gear need only not be organised. You go to get it sometimes and it's not there, or the boxes have been changed around and you think, 'Well, hang, blow it! I'm not going to be bothered chasing around'."
>
> (S.3 teacher)

In trying to provide for children, one teacher said,

> "there is not enough equipment for them to be able to work in small groups, and I mean groups of three or four at the most."
>
> (S.4 teacher)

The result, according to another teacher, is that

> "three-quarters of the class doesn't do each activity."
>
> (Junior class teacher)

The F.1-4 Project team also commented on lack of equipment (Working Paper No. 12, pp.1-6).

(b) Children 'fooling' with equipment can put some teachers off taking science

Some observers and teachers commented that when teachers have problems controlling the children in their care, the prospect of having children handle science equipment can be daunting and the experience of having them do so may be such that the teachers will avoid taking science for some time. For example,

"A lot of teachers are absolutely affeared that everything's going to be chaotic and dreadful, and of course some of them do it and it is."

(Teachers' College lecturer)

"... the moment we put equipment in some teachers' hand ... the lesson goes awry, and when it goes awry then that's maybe why they shy off teaching it, and I can say that I would probably think that's probably why it disappears from people's programmes. In actual fact they've lost confidence in themselves and their taking of it."

(S.4 teacher)

This problem of students using science equipment for non-approved purposes and the effect that this has on teachers taking science was also mentioned in a F.1-4 Project report (Working Paper No. 5, p.10).

3. Science Education Goals

(a) Content/knowledge emphasis

Five 'outside observers' suggested that teachers tend to see their role in science teaching as getting across a body of science knowledge to the children. For example,

"They don't see it as a method of study or research. They see it as a body of content which they try to get across."

(Primary Inspector)

"I see a lot of programmes made up and they look good, quite good on paper. They list skills they hope to bring out in particular topics, but I think generally speaking it reverts back to the topic of content-type material."

(Science Adviser)

"It (science teaching) tends to show a greater emphasis on the concepts, just the knowledge."

(Teachers' College Lecturer)

This outlook was implicit in many remarks made by teachers, of which the following are examples:

"... there still has to be that correct answer at the end. That's what we're saying, isn't it?"

(S.4 teacher)

"I think it's (teaching) you know, just increasing their (children's) knowledge."

(J.3/S.2 teacher)

This emphasis on knowledge was also reported by the F.1-4 Project team (Working Paper No. 5, p.6). At the primary level some teachers adopt this as their main science education goal when they fear they may have control problems with the children when trying to reach other goals.

(b) Process skills given lip-service

Many teachers talked about helping children develop the skills or processes of science and about challenging children to think but few probably do so, as one teacher suggested:

> "We still don't encourage them (children) to experiment and really think."
>
> (S.4 teacher)

A similar situation was noted by the F.1-4 Project members (Working paper No. 2, p.3; Working paper No. 7, p.5) and also by Harlen et al (1981) in Britain.

(c) Science turns out to be language

Four of the 'outside observers' commented on science getting 'lost' in a centre-of-interest or language approach.

> "... they're not doing science so much as they're doing language."
>
> (Primary inspector, 5J)

> "The booklets (science) are used for a theme approach which probably does relate to language rather more than science."
>
> (Primary principal)

However, as one principal noted, the teachers may believe that they're taking science.

> "I feel that they think that they're doing science."
>
> (Primary principal)

Not all teachers think this, though. One teacher felt that language development is the main thing and that science and other subjects serve as means to the language end.

> "I also perceive science as being primarily a vehicle for the development of language, and the development of science

concepts is something that happens fortuitously along with the development of science language, particularly so in the infants."

(S.2/3 teacher)

(d) Science as a separate entity from real life

Five of the 'outside observers' suggested that teachers tend to separate science from real life situations.

"... teachers are a bit inclined to keep the science locked up as a thing apart."

(Primary principal)

"... school science doesn't relate to life-science."

(Primary inspector)

4. Amount of Science Taken

(a) Difficult to establish

Although all of the children interviewed said that they had had some science and although some 'outside observers' believe that there is more science being taught in primary schools today than previously, twelve of the 'outside observers' reported that little science is taken.

"Science is disregarded by the vast majority of teachers."

(Primary inspector)

Another inspector described his experience.

"When I first started as an inspector, in the first year I don't think I would have seen more than two or three science lessons and that's being in schools about, well 90% of the year. Now that they know I'm responsible for science they tend to show me a bit more (laughs) but in general, no, you don't see it. If there's something goes by the board it's either science or music."

(Primary inspector)

This is supported by two teachers who related how, in their experience, science is one of the first subjects that teachers put aside, and it often gets left out.

It would probably be reasonable to conclude that a few teachers take science regularly but that others tend to avoid it, taking it only intermittently and somewhat reluctantly, as the remark of one teacher reveals. For this teacher, science is

"Something I've been told to take and have got a few units shoved in front of me which I teach from."
(Std.3 teacher)

(b) Tendency to avoid science teaching is not made public

In the experience of one inspector, teachers make provision for teaching science but they may not take it.

"I think from what I see documented (in teacher work plans) that things are happening but I don't always observe these things happening."
(Primary inspector)

A teaching principal reported that teachers may claim to be teaching science when they are not.

"I think people (teachers) often say it's (science teaching) going on and it isn't going on."
(S.2/3 teacher)

5. Teaching Methods

(a) Teacher domination

Three of the 'outside observers' specifically said that science lessons tend to be teacher-dominated, while others implied that this was so. Seven of the 'outside observers' referred to the way that teachers try to impose a predetermined or 'right' answer on children. One inspector described what happens:

"They (teachers) only ask questions when they know the answers exactly and if they don't get the answers they will keep nodding and looking until they get the answer they want and the words they want."
(Primary inspector)

Such domination provides a measure of teacher security. Another inspector described a different strategy that a number of teachers use that enables them to control the lesson and thus avoid being asked questions that they can't answer.

"Well a lot of them stick to the blackboard note-taking exercise whereby they set up the structure of the lesson and the kids copy it down so that, you know, it stays within the path and they (teachers) don't get caught."
(Primary inspector)

According to another inspector some teachers will at times, take special steps to ensure that a particular result is obtained, or a particular idea is confirmed.

> "A lot of it's almost the magic touch whereby if it doesn't work this time, well, we'll fake it up and show you that it can work."
>
> (Primary inspector)

(b) Children's differing abilities, prior knowledge and developing ideas tend to be ignored

Some teachers said that they acknowledged children's interests and planned to take account of these but four teachers claimed that teachers don't necessarily appreciate the significance of children's differing abilities, prior knowledge and developing ideas for science learning. One of the four said,

> "... many teachers assume that they (children) know more than they really do in terms of knowledge and in terms of the skills that they can apply."
>
> (Std.2/3 teacher)

Some children suspect that their teacher does not take their ideas into account during a science lesson.

> "He's probably not really thinking about it. He's probably just wondering if we're able to do it or really listening to him."
>
> (S.3 girl)

One boy described how one of his teachers talked on about,

> "... sort of the things that I'd read in books and sort of I'd heard millions of times and that."
>
> (F.1 boy)

This failure by some teachers to take into account the children's prior knowledge and skills was reported by the F.1-4 Project team as well (Working Paper No. 7, p.3).

(c) Some teaching is incompatible with scientific inquiry

One primary inspector succinctly summarised this issue when he mentioned that many teachers teach children to conform to their requirements, a process that runs counter to scientific inquiry.

Six teachers themselves recognised this.

> "The way of science as I understand it is to help children to explore, arrive at knowledge through manipulation, observation and so on but I think in some ways this goes against the grain because methods in other subject areas aren't always run along these lines."
>
> (S.3/4 teacher)

The effect on children, as five teachers said, is to stifle inquiry.

> "Yes, I think it's the way you teach things could even perhaps squash an enquiring mind."
>
> (J.3/S.2 teacher)

One teacher mentioned how the children have,

> "... got a problem of maintaining that open-minded approach to things because in this day and age we seem to gear them up towards a right and wrong answer."
>
> (S.2/3 teacher)

One primary principal reflected on this same issue:

> "I think that as a race we (teachers) do inhibit kids asking questions because we talk too much ourselves."
>
> (Primary principal)

And on the basis of his observations, another primary principal commented,

> "I tend to think that there are a lot of teachers who would ... stifle questions or direct questions in a way to suit themselves rather than children."
>
> (Primary principal)

The F.1-4 Project research reported on a similar problem at the level it investigated (Working paper No. 9, p.12) and the situation is little different in many British primary schools (HMI Report, 1978).

6. Syllabus

(a) Science syllabus and resource units

(i) Appreciated by teachers: The recent infants - standard 4 syllabus and resource units were, without exception, reported by teachers to be much better than anything else previously available. A reasonably typical remark was,

> "I find the units excellent to work from."
>
> (NE/S.2 teacher)

(ii) Extensive: The choice possible among the extensive range of available units was appreciated by many teachers interviewed. On the other hand one experienced teacher found the array of topics somewhat bewildering.

> "... so much has come out recently it's a little bit baffling just thinking about getting into it because I've been away from the science scene for some time."
> (S.3/4 teacher)

Several teachers felt that it might be desirable to 'asterisk' some units as core units and label the others 'optional' as a way of providing a more manageable structure. Others spoke of 'pruning' the number of units.

(iii) Inappropriate development basis: A further reservation that one person had was that the present syllabus did not sufficiently take into account the reality of many teachers during the development phase.

> "It was developed by enthusiastic teachers for enthusiastic teachers and really if the syllabus is going to work it's got to be teachable by the bottom 20% of teachers as well as the top 20%."
> (Teachers' college lecturer)

Her Majesty's Inspectors' Report (1978) indicated that primary science programmes in Britain had a similar shortcoming.

(b) Primary school syllabus

Both primary inspectors and teachers commented on the extensive number of subjects in the primary school syllabus that teachers are expected to teach. Given this diverse teaching load and in some cases pressure to concentrate on the 'basics', teachers may have problems finding time to fit science in. Ten teachers in fact mentioned time as a constraint.

> "Our day is so crowded that, you know, suddenly science gets the last bit in the day."
> (Junior class teacher)

On occasions of course it doesn't even get that.

This feature of the primary school syllabus and the difficulties it can place on teachers was also noted by the F.1-4 Project research (Working Paper No. 4, p.6).

7. Teacher Background in Curriculum Process

The remarks of one of the teachers interviewed suggested that she lacks an understanding of curriculum process and is guided by the authority of the written word. The following extract shows how the teacher, who was not happy about teaching 'rocks' came to realise through verbal confrontation that the written word is a human construction and as such is open to critical appraisal.

> "We saw it's there (in the school scheme) and we supposed we really should do something about rocks in the next two weeks."

Further discussion elicited the fact that the teacher and two colleagues had written the scheme themselves.

> Interviewer: You put it there yourself?
>
> Teacher: Yeah, I suppose we did, yes ... because it was there (in the syllabus) (laughs). (After musing on other topics they could have included instead, the teacher continued.) Yeah, that's an interesting point isn't it. You know, we put it there so it's kind of our fault. We're stuck with it aren't we?
>
> Interviewer: Well that's an interesting point in itself. If it gets down on paper, does it tend to get stuck there?
>
> Teacher: It is stuck there (laughs). What we should do is evaluate it and say, "Well, look, should it really be there? Is it a worthwhile topic?"
> (Junior class teacher)

The remarks of another teacher suggested that he is also dependent on authority in science curriculum matters.

> "You've got to use what's offered. You know, you don't have to go outside those units that are being offered. That's what people get paid thousands of dollars to do."
> (S.1 teacher)

CONCLUSION

Six of the 'outside observers' concluded that primary science teaching at the present time is superficial and this is the distinct impression conveyed to the author by most of those interviewed. It is superficial in the sense that it receives little teaching time and even where it does receive adequate time it is a matter of 'covering topics' rather than helping children learn. The objective seems to be to try to put into children's heads certain predetermined knowledge which the teachers themselves do not fully understand in many cases. This is usually done in a way that is contradictory to scientific inquiry. The result is that little science learning takes place even on those occasions when the children are engaged in various enjoyable activities. Perhaps the essence of what is happening is conveyed in the remarks of three of the 'outside observers'. One primary inspector observed that science lessons have a,

> "feeling of superficiality and gimmickry."
> (Primary inspector)

A principal commented,

> "I don't think you'll find depth. It's a skimming process."
> (Primary principal)

On the basis of his experience another inspector concluded,

> "I would say that 60% to 70% of teachers struggle with science. I don't see very many good science lessons."
> (Primary inspector)

The situation in primary schools in Britain (Bainbridge, 1980; Harlen et al, 1981; HMI Report, 1978; Plimmer, 1981), the United States of America (De Rose et al, 1979; Rudman, 1978) and Australia (Appleton, 1977; Stamp, 1982; Symington, 1974) is apparently little different.

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